

# Review of Medical and Surgical Management of Postpartum Hemorrhage

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There are two great fears for those who attend childbirth; these have not changed over centuries. The first is massive postpartum hemorrhage and the other is a shoulder dystocia. Postpartum hemorrhage is a significant cause of maternal morbidity and mortality worldwide among both developed and developing countries. This problem daily faces the 35,000 obstetrician/gynecologists and 17,000 family physicians who deliver about a million babies yearly in this country.

## Case Report #1

Early in my career, just after completing residency training, I was summoned to help another physician in the labor suite. This physician was older, very experienced, a skillful surgeon, and adept at managing almost any type of OB/GYN emergency. I was only told that he needed help as soon as I could get there. I was very suspect when I arrived, because blood was flowing out from under the closed door to the labor room. I quickly opened the door, and there was blood everywhere . . . the floor, the ceiling, the walls, the patient, the staff, and the obstetrician. There had been enough bleeding to completely cover the floor and partially cover my shoes. I had been a medical student and an OB/GYN resident, but I had never seen anything like this. The OB/GYN had one hand in the vagina and the other was compressing the uterus on the abdominal wall. The patient was bleeding profusely. One nurse was transfusing blood as fast as it could be squeezed in while the other nurse was summoning the blood bank for more blood. A complete blood count and coagulation profile had been drawn by the lab. As I walked into the room, the lab reported the CBC with hemoglobin of 1.5 and hematocrit of 5. I had never seen numbers that low in a living person.

The patient was very pale as would be expected. There was no urine output and no palpable vital signs. The older practitioner looked at me and said, “Got a lot of bleeding . . . will you assist me with a hysterectomy?” Although I responded with the affirmative, I did not see how this patient could possibly survive. I had never seen this much blood come from one individual. The patient was receiving blood, but it was coming out quicker than it was going in. She had three large bore IV lines. The patient was quickly moved to the cesarean section operating room for hysterectomy. The older physician and I did not scrub . . . we just put on gowns and gloves. The instruments were not counted. The patient received crash general anesthesia, and we cut. The tissues did not bleed because there was no blood in them. It reminded me of an autopsy, because those tissues do not bleed either; but, of course I was not going to say that.

The operation went quickly. We did a supracervical hysterectomy and left some of the cervix. Even at the end of the hysterectomy, it did not look like she would survive – but she did. She had a long hospital course and received a lot more blood, but lived to go home. I’ve always wondered if she or her family had any idea how close she came to dying and what was involved with saving her life. The older physician thanked me for my help. I left with a great respect for massive postpartum hemorrhage.

## Postpartum Hemorrhage

Postpartum hemorrhage crosses the path of most specialties: OB/GYN, family medicine/obstetrics, maternal-fetal medicine, anesthesiology, surgery, trauma, adult medicine special-

ties (internal medicine and family medicine), medical subspecialties (pulmonary, renal, hematology/ oncology), hospitalists, intensivists, radiology including interventional, pediatricians, neonatologists, pathologists with blood bank and transfusion medicine, and urology. Should the patient expire, the pathologist may again be involved with an autopsy. Hence the old adage about a very sick patient, “Every service is seeing the patient except psychiatry.”

The traditional, time-honored definition of postpartum hemorrhage is more than 500 ccs of bleeding after a vaginal delivery or more than 1,000 ccs of bleeding after a cesarean section. Unfortunately, obstetricians, like other surgeons, grossly underestimate the amount of blood loss at surgery. It is a good idea for another experienced health care provider, such as a CRNA, experienced circulating nurse, or anesthesiologist to objectively estimate the blood loss. Underestimating the blood loss makes the surgeon look good and feel good but may put the patient at risk for underestimating a significant problem. Newer definitions of postpartum hemorrhage include blood loss that causes a 10% change in hematocrit or blood loss that requires transfusion.

There are several important considerations about blood loss in healthy pregnant women. There is a dilutional effect of pregnancy in which the plasma almost doubles during pregnancy out of proportion to the solid components, giving the effect of anemia. Most healthy reproductive-age women can tolerate a significant amount of blood loss without requiring transfusion. Most women can tolerate a hematocrit down to 18 or 20 without the need for receiving blood. Oral iron two or three times a day for a few weeks will normalize the hematocrit. Another consideration is the size of the uterine arteries. At term, the uterine arteries are about the size of a 3/4” garden hose. Laceration or transection can cause massive hemorrhage in a very short period of time.

As a chair of a medical school OB/GYN department, I meet with students during their orientation to our service. I tell each of them that I expect that at the end of the clerkship each one will be able to deliver a baby vaginally without help or equipment in the foyer of the First Baptist Church, in the parking lot at Wal-Mart, and in the mission field in Honduras. At the end of the rotation, I confirm with each of them that they can do this. I complicate the story by telling them that they have massive postpartum hemorrhage and what can they do to manage this with no drugs or equipment. First and foremost, they can rub the fundus of the uterus against the mother’s backbone. They could compress the uterus between a hand on the fundus and a hand in the vagina. They could manually evacuate the uterus if needed. As a general rule, students’ first response to bleeding is to give the patient some pitocin. Unfortunately, there is no pitocin at churches, Wal-Mart, or the mission field. But there is natural oxytocin. Put the baby on the mother’s breast and let it suck. This releases natural oxytocin and will make the uterus contract. If she will not do this, ask her to rub her nipples as in a nipple stimulation test; this also releases natural oxytocin and will make the uterus contract.

## Causes of Postpartum Hemorrhage

Most cases of postpartum hemorrhage are due to uterine atony. The causes are listed in Table 1.

**Table 1:** Causes of Uterine Atony.

CAUSES OF UTERINE ATONY
General anesthesia
Poorly perfused myometrium in shock
Overdistended uterus with multiple fetuses
Excessive amniotic fluid
Following rapid or prolonged labor
Oxytocin induced or augmented labor
Grand or high multiparity
History of prior uterine atony
Chorioamnionitis
Uterine fibroids
Placenta previa
Following tocolytic therapy
Following magnesium sulfate therapy

Postpartum hemorrhage can also occur as the result of retained placental tissue in an avulsed cotyledon, a succenturiate or accessory lobe, an abnormally adherent placenta accreta, increta or percreta, or a placental abruption. Other causes of postpartum hemorrhage include uterine rupture, genital tract lacerations, uterine inversion, or coagulopathies.

## Management of Postpartum Hemorrhage

First and foremost, early in the management of postpartum hemorrhage and any massive bleeding, GET HELP! Physicians always think of this late. Inexperienced practitioners do not realize that they are in trouble and need help, while more experienced practitioners know they are in trouble but are hoping it will get better any minute, and they will not need help. Help depends on where you are. Help in a 40-bed rural hospital, where you are the only physician who delivers babies, is very different from a 600-bed teaching institution with house staff and every specialty of medicine available. In a large metropolitan, teaching hospital, often there are other OB/GYNs, trauma surgeons, general surgeons, vascular surgeons, chief residents, fellows, and family physicians that practice obstetrics. In a rural hospital, it could be a non-OB physician, a paramedic, a nurse from another floor, a family member who is a scrub tech, a unit clerk, or a maintenance worker who knows CPR or who works part-time as an ambulance attendant.

Getting help also means alerting anesthesia, the nursing staff, the blood bank, and the operating room for an impending disaster. Estimate the current blood loss and start replacing it. Inform the blood bank how much blood you need and how much you could possibly need to stay two units ahead. Any actively bleeding patient needs at least two large-bore IV lines through which blood and blood products can be transfused. Draw a CBC and coagulation factors to see where things are at the present. Try to determine the most likely source of the bleeding and the best access to it, abdominally or vaginally. Inform the patient and family of what is going on and the emergent nature of the problem.

## Medical Management of Postpartum Hemorrhage

The basic maneuvers in the management of postpartum hemorrhage are discussed above. Massaging the uterus and compression and evacuating the uterus will stop most bleeding. The first line of treatment for bleeding due to uterine atony is uterotonic medications. Natural pitocin or oxytocin can be elicited by breastfeeding or rubbing nipples as in a nipple stimulation test described above.

**Oxytocin (Pitocin)** is the first line of medical therapy. It is usually available in a labor and delivery unit. It may not be available in a hospital that does not do obstetrics. It can be administered IV, IM, intrauterine, or as a continuous infusion. It works very well with massaging and compressing the uterus.<sup>1</sup> High doses can cause water intoxication due to its antidiuretic effect, which lasts for several days. Pitocin also elevates blood pressure so its use in a hypertensive patient requires close monitoring.<sup>1</sup>

**Methylergonovine (Methergine)** is used to make the uterus contract. It is an old drug, and, unfortunately, it elevates blood pressure and should not be used in patients that are hypertensive or eclamptic.<sup>1</sup> There is only one dose, and it is 0.2 mg IM q 2-4 hours. The same dose can be given orally every six hours.

**Prostaglandin F 2 Alpha (Hemabate)** is often used when Methergine is contraindicated. The dose is 250 mcg IM or IU every 15-90 minutes up to a maximum of eight doses.<sup>1</sup> It usually provokes the usual prostaglandin side effects of fever, red rash, nausea, vomiting, flushing, chills, and headache.<sup>1</sup> It is contraindicated in cardiac, hepatic, pulmonary, and renal disease.<sup>1</sup>

**Prostaglandin E 2 (Dinoprostone)** is given as a 20 mg rectal suppository every two hours. It has the same side effects as Hemabate.<sup>1</sup> It is contraindicated with hypotension.<sup>1</sup>

**Misoprostol (Cytotec)** is given as a single dose 600-1,000 mcg PO or PR.<sup>1</sup> It has the same side effect profile as the other prostaglandins.<sup>1</sup> It is regularly used in OB/GYN because it is very inexpensive. There are no known contraindications except an allergy to it.

**Calcium Gluconate** is the antidote for magnesium sulfate (MgSO<sub>4</sub>) or nifedipine when these agents have been used to

relax the uterus in preterm labor or to prevent eclampsia.<sup>1</sup> Usually one ampule is sufficient, and it is given by slowing injecting ½ ampule IV at a time.

**Recombinant Activated Factor VII** is a synthetic vitamin K-dependent protein used successfully for intractable traumatic and surgical bleeding when everything else has failed, including hysterectomy.<sup>4</sup> It may not be readily available in all hospitals.

**Transfusion of Blood and Blood Products** is used as necessary to manage postpartum hemorrhage.

## Case Report #2

A 35-year old Middle Eastern female p1001 presented for prenatal care following a term pregnancy two years previously that had culminated in a delivery by low transverse cesarean section. That pregnancy had been uncomplicated, and the patient was very compliant. With the current pregnancy, her only complaint was daily, painless bleeding. On vaginal speculum examination, there was blood oozing from the upper portion of the cervix. It could not be determined if this was a placenta previa or cervical pregnancy. A pelvic ultrasound was performed with the diagnosis of "cervical pregnancy." She was referred to our main campus department of OB/GYN for maternal-fetal medicine consultation. Their diagnosis was probably very low lying placenta previa, but since there was a possibility of cervical pregnancy, termination was offered.

The patient declined termination and returned to our campus for continuation of prenatal care. She presented every week for obstetrical care. She took prenatal vitamins and extra iron and maintained her hematocrit; however, she was bleeding every day. At 39 weeks gestation, a repeat low transverse cesarean section was performed by an experienced OB/GYN attending and an obstetrics fellow. The placenta was removed with some difficulty with excessive blood loss controlled with over-sewing the lower uterine segment. In the recovery room, the patient began bleeding briskly from the vagina with an estimated 2,000 ccs of blood. She lost her pulse and blood pressure before arrival of the obstetrics team. She was resuscitated by the anesthesiologist with four units of packed red blood cells and pressors. She was stabilized and returned to the operating room and re-explored. Bleeding from the lower uterine segment and cervix was massive, and a peripartur total abdominal hysterectomy was performed.

The patient was transferred to the Surgical Intensive Care Unit in stable condition. She continued to receive blood and blood products along with pressors. Pulmonary, renal, and intensive care services were consulted. She became hypotensive that afternoon and was re-explored by trauma surgery, general and vascular surgery, and three OB/GYN senior attending physicians, and the bleeding stabilized. She was given more blood and blood products including cryoprecipitate. Urology repaired a laceration of the bladder from the previous operation. The following day she became hypotensive and was re-explored again. At this point, the blood bank, which serves a 600-bed hospital and trauma center, had been depleted of blood and blood prod-

ucts twice. Activated Factor VII was obtained from the American Red Cross 45 miles away and relayed to the hospital by the Alabama State Police. The Activated Factor VII was given as a last resort to control bleeding and her bleeding ceased. She was closed and eventually resumed bowel and bladder function. She was discharged home about postoperative day ten. She has done well since that time.

## Surgical Management of Postpartum Hemorrhage

There are many surgical methods used to control bleeding from the uterus in a postpartum hemorrhage as listed in Table 2.

**Table 2:** Surgical Management of Bleeding.

<b>Exploration of the uterus if not done already</b>
<b>Compression of the uterus</b> Continuous bimanual massage Fundal compression Lap packs tied around the uterus Closed massage of the abdomen
<b>Hot intrauterine douches are no longer used</b>
<b>Packing to control bleeding</b> Vaginal packing Uterine packing (requires anesthesia) Packing other sites Umbrella pack in the pelvis after hysterectomy
<b>Temporary vascular occlusion</b> Rubber-shod Kelley clamps across the uterine and utero-ovarian vessels Compression of the aorta— <b>ALWAYS ALERT ANESTHESIA!!</b>
<b>Arterial ligation</b> O’Leary-O’Leary ligation of the uterine vessels Hypogastric artery ligation Ligation of utero-ovarian vessels
<b>Compression sutures</b> B-Lynch sutures Uterine over-sewing Multiple square knots in the myometrium
<b>Segmental resection of myometrial wall</b>
<b>Selective arterial embolization<sup>1</sup></b>
<b>Cesarean hysterectomy</b> Supracervical hysterectomy Total abdominal hysterectomy

**Exploration of the uterus** can be performed, if not already done, abdominally if the abdomen is open or vaginally if closed or following a vaginal delivery. Remaining fragments of placenta or clots preventing contraction of the uterus should be removed.

**Compression of the uterus** can be performed manually with abdomen open between two hands to control bleeding. If the abdomen has been closed or in a vaginal delivery, the uterus can be compressed by one hand in the vagina and one on the abdomen, bearing in mind that, if the patient is without anesthesia, this may be painful. Lap packs can be tied around the uterus if the abdomen is open to control bleeding.

**Hot intrauterine douches** are no longer used to control bleeding but are mentioned for completeness sake.<sup>2</sup>

**Packing** has been used by OB/GYNs for centuries to control bleeding from the uterus, cervix, and vagina and can be used in other sites as well. Packing tamponades bleeding vessels to allow the natural clotting cascade to occur, which should be successful within one hour if there are no coagulation defects.<sup>3</sup> Patients cannot tolerate uterine packing without anesthesia. The maximum packing time is 24 hours, at which time the packing should be removed and bleeding re-evaluated.<sup>3</sup> An umbrella packing can be used to compress bleeders in the pelvis after a hysterectomy has been performed, when there is continued bleeding.

**Temporary vascular occlusion** is used to control bleeding awaiting completion of a more definitive procedure. Rubber-shod Kelley clamps are made by inserting the proximal two inches of a red rubber catheter onto the clamps of a Kelley clamp, making it atraumatic. These can be applied atraumatically across utero-ovarian and uterine vessels to control bleeding. In massive hemorrhage, the distal aorta can be compressed above the bifurcation by placing a moist lap towel in this area and gently applying pressure. *This should never be done without alerting anesthesia* to manage the changes in blood pressure!

**Arterial ligation** decreases perfusion, lowers pulse pressure, and helps control bleeding.<sup>1</sup> The uterine, utero-ovarian, and hypogastric vessels can be ligated. It is possible to ligate any three of the four uterine and utero-ovarian vessels without compromising the uterus and future fertility. *It is imperative that absorbable sutures be used.*

**O’Leary-O’Leary ligation of the uterine arteries** has almost replaced hypogastric artery ligation, because it is technically easier, quicker to perform, the vessels are easier to access, and the complications are much less. In an O’Leary-O’Leary ligation, a large absorbable suture is placed through the broad ligament lateral to the uterine vessel and into the myometrium posteriorly, then medial to the uterine vessel and tied anteriorly. For control of bleeding in uterine atony, one is placed just above the cervix bilaterally. If bleeding is from a laceration of the uterine vessel, a similar stitch is placed both above and below the laceration.

**Hypogastric or internal iliac artery ligation** is an old procedure that is uncommonly performed by general OB/GYNs today.<sup>5</sup> Other specialties, such as GYN, oncology, urology and vascular surgery, regularly perform the procedure. It has almost been replaced by O’Leary-O’Leary ligations as described above. Unfortunately, hypogastric artery ligation is

rarely taught in OB/GYN training programs today. The anterior branch of both hypogastric arteries is ligated to reduce pulse pressure and help control bleeding. This procedure is recommended only if the surgeon has the skill and expertise to complete the procedure. *This is not the time to try the procedure for the first time! There is significant risk of complications!* The ureter crosses the bifurcation near the point of ligation and is at risk for injury. Nerves entrapped in the ligature can cause neurologic defects. Ligation of the posterior branch of the hypogastric artery instead of the anterior causes ischemia of the buttocks. During residency training OB/GYN residents are told that, if the posterior branch is ligated, the buttocks will fall off. Ligation of the external iliac artery will cause diminished blood supply and ischemia to the lower extremity.

**Compression sutures** have been used to compress uterine vasculature and the myometrium to control bleeding with absorbable sutures.<sup>1</sup> In 1997 Christopher B-Lynch described brace sutures anchored anteriorly and posteriorly and extending over the top of the uterus to compress blood vessels to control bleeding.<sup>1</sup> These have become known as B-Lynch sutures or B-Lynch brace sutures.<sup>1</sup>

**Over-sewing** a bleeding site or implantation site may also be useful.<sup>1</sup>

**Multiple square knot sutures** in the myometrium are a variation of B-Lynch sutures to control bleeding.<sup>1</sup>

**Segmental resection of a portion of the bleeding myometrial wall** has been described.<sup>6</sup> The site of bleeding or of an abnormally adherent placenta can be excised, and the defect closed as in a myomectomy.<sup>6</sup>

**Selective arterial embolization** may be used when there are isolated bleeders causing hemorrhage, usually postoperatively. Pelvic angiography is used to visualize the bleeding vessels and place gelfoam pledgets to occlude the vessels and stop the bleeding.<sup>1</sup> The success rate is good when there are isolated bleeders.<sup>1</sup> The procedure requires an interventional radiologist and is limited by widespread availability. When successful, it may prevent opening or re-opening the abdomen.<sup>1</sup> On many occasions when the abdomen is re-opened after a laparotomy or cesarean section, bleeding sites cannot be found. In these cases, angiography may help identify bleeding sites.

**Cesarean hysterectomy** is the time-honored definitive procedure to control postpartum hemorrhage when all more conservative measures have failed. It is usually performed as a supracervical hysterectomy but occasionally as a total abdominal hysterectomy, particularly when bleeding involves the cervix or lower uterine segment. When the decision to perform a hysterectomy is made, usually there has already been excessive bleeding. The procedure is performed as an emergency under adverse conditions and carries with it an average blood loss of 2,000 ccs to 3,000 ccs. Usually, the procedure is performed as a life-saving, last-resort procedure that permanently ends fertility.

The procedure requires skill, speed, and dexterity. Only older OB/GYNs have experience with cesarean hysterectomy today. Cesarean hysterectomy is usually not taught in training programs today, and most new graduates have never seen one, much less had any experience with it. Family physicians that practice obstetrics rely on OB/GYNs when a cesarean hysterectomy is needed, yet new OB/GYNs do not have experience with it. A fairly simple technique for cesarean hysterectomy for obstetrician/gynecologists and family physicians practicing obstetrics has been recently published in the *American Journal of Clinical Medicine*.<sup>7</sup>

## Summary

Postpartum hemorrhage is a life-threatening emergency that is a common cause of maternal mortality if left untreated. It is important to recognize when the basic maneuvers to control bleeding have failed and to get help and alert assistants, the nursing service, anesthesia, blood bank, and the operating room. Know what you are comfortable with and have a plan if the worst should happen. Keep in mind what help is available. Keep a hysterectomy instrument tray, including sutures, in the cesarean section operating room or at least in labor and delivery. Keep the patient and/or spouse and family informed. Know who to call if a cesarean hysterectomy becomes necessary.

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## References

1. Foley MR, Strong TH, Garite TJ. *Obstetric Intensive Care Manual*. New York: McGraw Hill Co., Inc. 2004.
2. Baskett TF. *Essential Management of Obstetric Emergencies*. 3rd Edition. Bristol: Clinical Press Limited. 1999.
3. Quennan JT. *Managing OB/GYN Emergencies*. 2nd Edition. New Jersey: Medical Economics Cp. 1983.
4. Cunningham FG, Leveno KJ, Bloom SL, Hauth JC, Gilstrap LC, Wenstrom KD. *Williams Obstetrics*. 22nd Edition. New York: McGraw Hill Co., Inc. 2005.
5. Mukhopadhyay P, Naskar T, Hazra S, Bhattacharya D. Emergency Internal Iliac Artery Ligation—Still a Life Saving Procedure. *J Obstet Gynecol India*. 2005;55(2):144-145.
6. Kayem G, Deis S, Estrade S. Conservative Management of a Near Term Cervico-Isthmic Pregnancy, Followed by a Successful Pregnancy: A case report. *Fertil Steril*. 2008;89(6):1826.e13-15.
7. Avery DM, Hooper DE, Waits JB. Cesarean Hysterectomy for Family Medicine Physicians Practicing Obstetrics. *Am J Clin Med*. 2009;6(2):68-71.